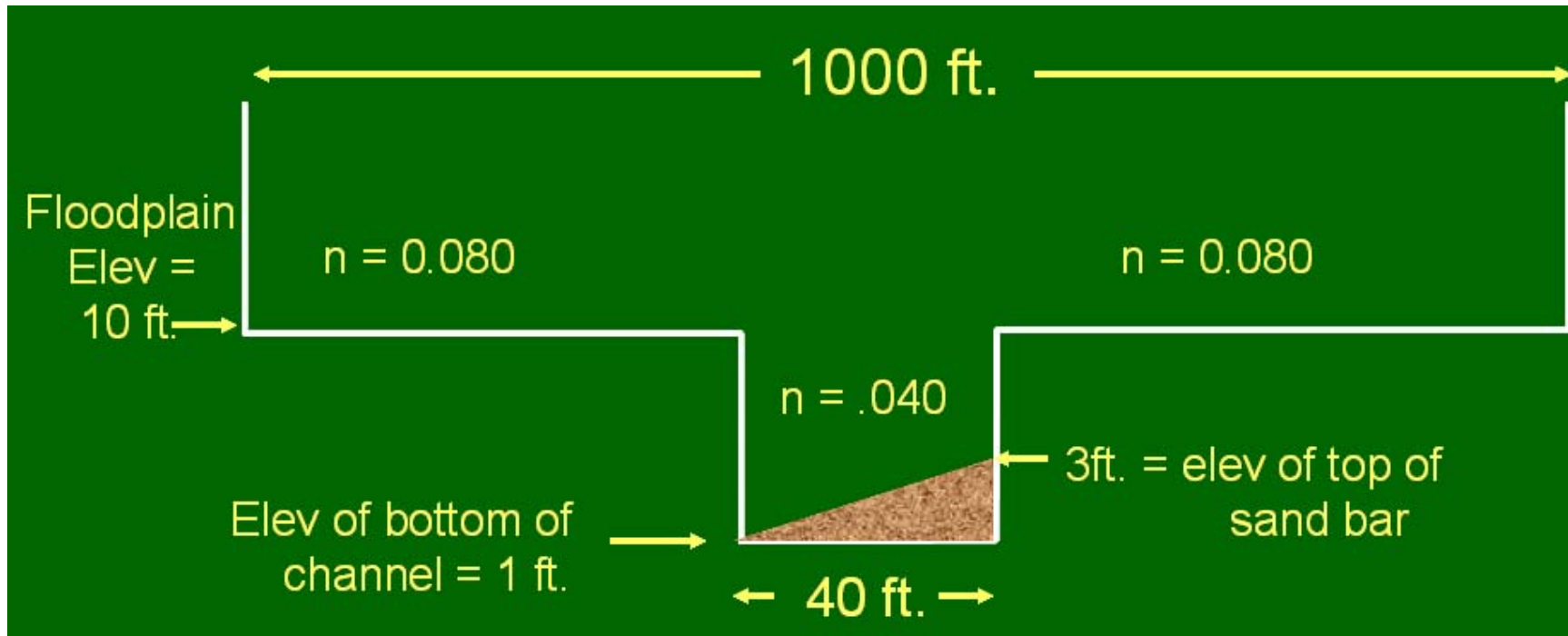


Exercise 5 - Rating Curve Development

- Develop and plot on the attached logarithmic graph paper a theoretical rating for the channel shown below. You will have to fill out five additional rows in the three data tables that follow. These rows are indicated by arrows.
- In working this problem, you should assume that the sand bar forms a section control. Also, assume that the weir equation applies for the sand bar and that Manning's equation applies for the rest of the channel. When channel control is in effect, the sand bar will be either drowned out or will be washed out.
- The weir equation is used to compute values for a section control, which is represented by the sand bar. Manning's equation should be used to compute data when flow is under channel control. Remember, this is a reach feature, not a single feature at one cross section. The area and wetted perimeter of the sand bar should be disregarded when using Manning's equation.
- Drawing the rating curve will consist of three separate but overlapping curves represented by the green, blue, and red values in the tables below. These are data for the section, channel, and overbank controls respectively. The lines resulting from these separate rating segments should be joined by smooth transitions to form a single rating.

| | |
|---|--|
| Weir equation: $Q = CLH^{3/2}$ where C = 2.5, L = Top width, in feet H = Average depth of flow, in feet | Manning equation: $Q = \frac{1.486}{n} AR^{2/3} S^{1/2}$ where: n = roughness coefficient A = cross sectional area R = Hydraulic Radius (A / WP) S = Energy slope (assume to be same as water surface slope) (= 0.0009) |
|---|--|

Schematic diagram of channel



A. Use the weir equation to complete the table below:

| GH | L | Ave. H | Q |
|-------|----|--------|------|
| 1 | 0 | 0 | 0 |
| 1.5 | 10 | 0.25 | 3.12 |
| 2 | 20 | 0.5 | 17.7 |
| 2.5 → | | | |
| 3 → | | | |
| 4 | 40 | 2 | 283 |
| 5 | 40 | 3 | 520 |
| 6 | 40 | 4 | 800 |

B. Now use Manning's equation to complete this table:

| | Main Channel | | | | Overbank channel | | | | Q(Total) |
|------|--------------|----|-------|---------|------------------|-----|-------|---------|----------|
| G.H. | A | WP | R 2/3 | Q(main) | A | WP | R 2/3 | Q(over) | |
| 3 | 80 | 44 | 1.49 | 133 | | | | | 133 |
| 4 | 120 | 46 | 1.9 | 253 | | | | | 253 |
| 5 → | | | | | | | | | |
| 6 | 200 | 50 | 2.52 | 562 | | | | | 562 |
| 7 | 240 | 52 | 2.77 | 742 | | | | | 742 |
| 8 | 280 | 54 | 3 | 935 | | | | | 935 |
| 9 | 320 | 56 | 3.2 | 1140 | | | | | 1140 |
| 11 | 400 | 58 | 3.62 | 1620 | 960 | 962 | 1.00 | 530 | 2150 |
| 12 → | | | | | | | | | |
| 14 → | | | | | | | | | |
| 16 | 600 | 58 | 4.75 | 3180 | 5760 | 972 | 3.27 | 10500 | 13700 |
| 18 | 680 | 58 | 5.16 | 3910 | 7680 | 976 | 3.96 | 16900 | 20800 |
| 20 | 760 | 58 | 5.56 | 4710 | 9600 | 980 | 4.58 | 24500 | 29200 |

C. Use the paper on the next page and the data in the tables above to plot the rating using an appropriate offset.

